

EXPERT REPORT

BOARHEAD FARMS SUPERFUND SITE Upper Black Eddy, Pennsylvania

Prepared for:
Phelan, Pettit & Biedrzycki

Prepared by:

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Alternative Environmental Strategies, LLC
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September 28, 2006

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1.0 Introduction and Summary of Opinions

We have been retained by Ashland, Inc. in this case, through the law firm of Phelan, Pettit & Biedrzycki, to review data and documents related to Boarhead Farms Superfund Site (Site) and to respond to certain opinions set forth in an expert report written by J. Vandeven dated June 30, 2006.

This section contains a brief history of the site and a summary of our opinions. Section 2 contains the basis of our opinions. Section 3 outlines our qualifications and Section 4 lists the documents considered by us in forming our opinions.

We reserve the right to modify or supplement this report if we become aware of additional information at a later date.

1.1 History

The Site comprises approximately 120 acres and is located on Lonely Cottage Road in Upper Black Eddy, Bridgeton Township, in Bucks County, Pennsylvania. The property was purchased by Boarhead Corporation in 1969. Information from various regulatory agencies, reports from a consultant to Boarhead Corporation and testimony from various employees illustrate that hundreds of thousands of gallons of waste was disposed at the site in bulk and thousands of drums were disposed of at the site beginning in the early 1970s.

The Bucks County Board of Health (BCBOH) began investigating the Site in 1972 for complaints of dead fish, plant life and foaming along the edges of a stream on property adjacent to the site. Site inspections in 1973 revealed the burial of drums, spillage of various chemicals, drums with no lids and drums of solvents. Several spills of acids containing heavy metals prior to 1976 have been documented.

Acidic wastes containing heavy metals were released at the site in various locations. The wetlands area (swamp) was determined to be impacted with ferrous chloride in October 1973. Analysis of waste samples pooled in the swamp had a pH of less than 1.0 (PADER, 1973a) and contained copper, chromium, nickel, zinc and chloride. Nine months later sampling performed by a consultant to Boarhead Corporation illustrated that there was still low pH surface water (pH 2.9) in the swamp area containing heavy metals (Betz Environmental Engineers, 1974).

Testimony from various former employees of Boarhead Corporation (DeRewal Jr., 2003; Shaak 2003), if accurate, indicate that various wastes were disposed of in bulk to the ground and drums were buried in various locations on the site beginning in the early 1970s. There was bulk disposal of acid pickling and plating wastes that would have a low pH (pH values less than 1 were reported) and contained various metals such as chromium, nickel, copper, lead, tin and zinc. Over 2500 buried drums were located and removed in 1992 and 1993.

AETC arranged for spent acid from Ashland Chemical to be sent to the DeRewal facility in Philadelphia from August 1976 to March or April 1977. Disposal of a number of loads was reported to have taken place at the Boarhead Farms facility instead (DeRewal, Jr., 2003; Shaak,

2003). If spent acid wastes generated by Ashland went to Boarhead Farms, the number of loads (and hence volume and total impact to the site contamination) and time period of Ashland activity is minimal compared to the large volume of waste released at the site from the early 1970s to 1977.

1.2 Summary of Opinions

The following is a summary of our opinions.

1. The alleged disposal of non-metal bearing acid wastes at the Site in or subsequent to August 1976 did not result in increased mobility of metal contaminants leading to increased response costs.
2. The alleged disposal of non-metal bearing acid wastes at the Site in or subsequent to August 1976 did not result in increased response costs from any potential increased mobility of contaminants from drummed wastes.
3. The alleged disposal of non-metal bearing acid wastes at the Site in or subsequent to August 1976, did not contribute to the environmental conditions that lead to soil remediation response actions in Operable Unit #2 (OU2).

2.0 Basis of Opinions

This section provides the basis of each of our opinions.

Opinion 1: The alleged disposal of non-metal bearing acid wastes at the Site in or subsequent to August 1976 did not result in increased mobility of metal contaminants leading to increased response costs.

Opinion 1A. There is no site-specific evidence presented supporting the claim that non-metal bearing acid wastes resulted in increased mobility of metals.

The expert report of Mr. Vandeven (2006) states, “Because most metals are more soluble in acidic solutions, the acidity of these wastes increased the mobility of metals in the subsurface environment.” (p. 13). However, Mr. Vandeven presents no analysis of the site-specific conditions to indicate what areas of the Site may have been impacted, what metals are potentially affected, and over what time frame such an impact could have occurred. As such, the contention that spent acid wastes generated by Ashland could have contributed to the extent and cost of remediation by increasing the mobility of metals is mere speculation, unsupported by any scientific analysis.

An analysis of the actual information available for the Site clearly demonstrates that Ashland’s spent acid wastes, and any other non-metal-bearing acid wastes potentially disposed of in the same timeframe, could not have contributed to the extent and cost of remediation related to metals, as further discussed in Opinions 1B through 1D.

Opinion 1B. Any potential impact of acids on metal mobility would be localized and short-lived.

The RI report (CH2M HILL, 1997a) addressed the potential impact of acids on metal mobility. The RI (p. 5-4) states “The effects of acid spills probably were short-lived because the acids would have been flushed from the soil by infiltrating water and possibly would have been neutralized by the limited buffering capacity of the soil.” Similarly, in a discussion of the potential degradation of waste constituents, the RI (p.5-5) includes the statement, “However, as noted above, the effects of acid disposal probably were short-lived and were localized in their areal distribution.”

The fact that any potential impact of acids is localized is further supported by the actual groundwater data reported at the site. Table 5-3 in the RI presents the pH values for 35 monitoring wells at the site. Most of the wells had reported pH values in the neutral range of pH 6 to pH 8. Only two wells near the source area (MW-20, pH 5.1, and MW-21, pH 3.9) had acidic pH values. Four wells had reported pH values in the alkaline range (above pH 8), exactly the opposite of the effect that acids would produce: MW-27, pH 8.6, MW-30, pH 8.6, MW-31, pH 10.1, MW-33, pH 8.24. Based on the actual groundwater monitoring data at the Site, there is no evidence that acid wastes could have affected metal transport in the areas down gradient of the source area.

Opinion 1C. The likely primary source of metal contamination at the Site was the high concentration of metals in pickling acid and other metal treatment wastes.

Based on the Site history reported in the RI, metal treatment wastes containing high concentrations of acids and metals were disposed of at the Site. The site history in the RI reports numerous instances of spills and releases of acid wastes at the Site prior to 1976, including:

- An acid spill to a stream from tank trucks was reported (April 28, 1972).
- A leak from a tank truck containing ferrous chloride (on or about October 30, 1973), and a reported similar incident in the summer of 1973. This waste had a reported pH near 1 (strongly acidic). This waste was subsequently identified as waste from pickling stainless steel (November 27, 1973).
- Green liquid with a pH below 1 was reported in the swamp at the Site (November 1, 1973).
- Mr. DeRewal indicated plans to bring 100,000 pounds of lime to spread at the Site, presumably to neutralize acid spills (November 5, 1973).
- Samples collected at the Site on July 4, 1974 indicated a pH of 2.9 at three locations, and concentrations of chromium, copper, nickel and zinc.

Metal finishing wastes are characterized by high acid concentrations and high concentrations of heavy metals. The metals, acids and chlorinated organic solvents found on the site are consistent with those known to be used in metal plating and finishing operations. (EPA, 1995b, 1996) Acidic metal finishing wastes are consistent with spills reported at the Site prior to 1976. These metal finishing wastes, and any similar wastes that may also have been disposed of at the Site, likely represent the primary source of heavy metals found at the Site. Because these metals were already present in strong acids, they would have already been mobilized to the extent that metals are mobilized under acid conditions. Due to the relatively high groundwater flow rates near the source areas at the site, any mobile constituents would have rapidly migrated down gradient of the source areas. Subsequent disposal of non-metal bearing waste acids could not have affected the mobility and transport of these materials. Therefore the extent of remediation of metals could not have been affected by subsequent disposal of acid wastes, such as the spent acid wastes generated by Ashland, even assuming that disposal had occurred at the same location as previous disposal of the metal finishing wastes.

In his 2004 deposition, when asked if metals were present in Ashland's spent acid waste stream Mr. Curley states, "No, there wouldn't be, to any extent. I wouldn't think so, no." We are not aware of any records or testimony that establishes the presence of metals in Ashland's spent acid, and heavy metals would not be expected to be present in this waste stream.

Opinion 1D. Acid conditions do not increase the mobility of all metals. In fact, several of the metals found in soil and groundwater at the Site are less mobile under acid conditions.

On page 7 of his expert report, Mr. Vandeven states' "The ferric chloride, copper ammonium carbonate, sulfuric acid, and other bulk liquid wastes (such as spent etching solutions, acids and pickling wastes) released at the Site generally contained substantial quantities of metals. Because most metal are more soluble in acidic solutions, the acidity of these wastes increased the

mobility of metals in the subsurface environment.” Firstly, as noted above, there is no evidence that Ashland’s spent acid waste contained metals. Secondly, although it true that acidic conditions can increase the mobility of many metals, this statement is incomplete and misleading regarding the potential impact of acids on mobility of the metals of interest at the site. The mobility of metals in the subsurface environment is controlled by a number of factors, including the form of the metal, pH, oxidation-reduction (redox) potential, inorganic and organic complexing agents, adsorption, precipitation, and biological activity.

The simple statement that acids increase the solubility of metals can reasonably be applied to metals in Group I and Group II of the periodic table. Common metals in these groups include sodium, potassium, calcium and magnesium. These elements are typically found in the environment as positively charged metal cations, with a +1 or +2 charge. The environmental chemistry of other metals, referred to as transition metals and metalloids, is much more complex. These compounds may exist with various charges (referred to as valence states), and may be present in the environment in positively or negatively charged forms. When present in negatively charged forms, the mobility of metals is decreased by acid conditions, the opposite of the effect predicted by Mr. Vandeven. This is particularly important in the context of the metals found in groundwater at the Site.

In his discussion of the basis for remedial action at the Site, Mr. Vandeven cites the RI and the Human Health Risk Assessment (HHRA), “The RI Report describes the nature and extent of contamination associated with the Site. It also includes the baseline Human Health Risk Assessment, which identifies 16 metals and 37 organic compounds as contaminants of potential concern and concludes that the risks associated with on-site and off-site groundwater exceed the acceptable limits due to elevated levels of volatile organic compounds (“VOCs”) and metals (especially arsenic and chromium).”

The following discussion briefly summarizes the key factors controlling the environmental mobility of arsenic and chromium, the two specific metals highlighted by Mr. Vandeven.

Arsenic. Arsenic is a metalloid. Depending on the redox conditions, arsenic may be present in two valence states in the environment, As(III) and As(V). In groundwater, under reducing conditions, arsenic is generally found as arsenous acid (H_3AsO_3). In oxidizing conditions, the arsenate forms ($H_2AsO_4^-$ and $H_2AsO_4^{2-}$) dominate. The reduced (arsenous) forms are generally more mobile than the oxidized arsenate forms. However, regardless of redox conditions, both forms of arsenic are present as neutral or negatively charged oxyanions, and both are more soluble under alkaline conditions, not acid conditions as suggested by Mr. Vandeven’s deposition. Transport of arsenic is generally controlled more by adsorption to soils than solubility alone; for both arsenic forms adsorption is reduced, and mobility is increased, under alkaline conditions. (EPA, 2006a; ATSDR, 2005a) Simply stated, arsenic in the environment is more mobile under alkaline conditions than acid conditions. Similar behavior is typical of other metalloids generally present in the environment as oxyanions, including selenium and antimony.

Chromium. The environmental chemistry of chromium is somewhat more complex. Chromium is a transition element. Like arsenic, it has more than one valence state. In the environment, chromium is generally found in the trivalent (Cr(III)) or hexavalent (Cr(VI)) forms. The

hexavalent form is generally considered the toxic form of chromium. (The trivalent form of chromium is used as a nutritional supplement.) The trivalent form, which predominates under reducing conditions, generally has lower mobility than the hexavalent form, which predominates under strongly oxidizing conditions. The trivalent form of chromium is generally present in soils as an insoluble oxide (Cr_2O_3). When dissolved in water, $\text{Cr}(\text{III})$ is generally present as a positively charged ion ($\text{Cr}(\text{OH})_2^+$). The trivalent form of chromium is generally more mobile under acidic conditions. On the other hand, the hexavalent form of chromium is a negatively charged oxyanion (CrO_4^{2-} or HCrO_4^-). As with other anions, these forms are mobilized under alkaline conditions. Simply stated, the toxic hexavalent form of chromium is more leachable and more mobile under alkaline conditions than acid conditions. (EPA, 1994, 2006b; ATSDR, 2000) This is exactly the opposite of the effect of acids suggested by Mr. Vandeven's report.

The environmental behavior of arsenic and chromium discussed above demonstrates that a conclusion that acids may have increased metal mobility, even if co-disposal occurred, is geochemically incorrect when applied to the two specific metals, arsenic and chromium, highlighted by Mr. Vandeven.

Summary of Opinion 1: Spent acid wastes generated by Ashland could not have contributed to an increase in metal mobility resulting in increased remediation costs because:

1. No scientific analysis has been presented to indicate that increased mobility has occurred, or could have occurred, for the actual conditions at the Site.
2. Any potential impact of acids would be localized and short-lived, as discussed in the RI, and thus would not significantly affect the distribution of contaminants at the Site. Actual groundwater data at the Site demonstrate that the impact of acids is localized.
3. The primary source of heavy metals at the site was likely in the form of acidic metal treatment wastes. Disposal of these wastes has been documented to predate any alleged disposal of wastes generated by Ashland at the Site. To the extent that acid conditions mobilize metals, spent acid wastes generated by Ashland, and other non-metal bearing acid wastes potentially disposed of in the same timeframe, could not have increased the mobility of metals in the acidic metal treatment wastes disposed of at the Site. Ashland's spent acid wastes did not themselves contain metals.
4. A conclusion that acid conditions increase metal mobility is geochemically incorrect for the two specific metals, arsenic and chromium, highlighted by Mr. Vandeven. The mobility of arsenic and the toxic hexavalent form of chromium are actually increased under alkaline conditions and decreased under acid conditions, exactly the opposite of the effect suggested by Mr. Vandeven's report.

Opinion 2: *The alleged disposal of non-metal bearing acid wastes at the Site in or subsequent to August 1976 did not result in increased response costs from any potential increased mobility of contaminants from drummed wastes.*

Opinion 2A: *The distribution of contaminants disposed of as bulk wastes could not have been affected by co-disposal with non-metal bearing acid wastes at the Site in or subsequent to August 1976.*

The record is clear that extensive quantities of wastes were disposed of in bulk at the Site, and that such disposal pre-dated any alleged disposal at the Site of any wastes generated by Ashland. Contaminants in these bulk wastes would have immediately entered the soil and groundwater system, and independent of any subsequent waste disposal, would have determined the extent of groundwater impact. Opinion 1 above presents a discussion of the factors determining the extent of metal contamination at the Site, demonstrating that Ashland's waste did not affect the extent of metal contamination at the Site. Opinions 2B and 2C below present additional analysis, demonstrating that non-metal bearing acid wastes at the Site in or subsequent to August 1976 could not have impacted the extent of volatile organics found in groundwater at the Site, or the extent of soil contamination associated with drummed wastes.

Opinion 2B: Organic releases at the site would have traveled in the groundwater past the location of the groundwater interceptor trench and extraction wells prior to 1976. These organic releases created the necessity for the groundwater extraction remedy independent of any alleged releases of wastes generated by Ashland.

A three-dimensional groundwater flow and mass transport model has been developed for the Site (Brown and Caldwell, 2004b). The model simulates groundwater flow and contaminant (TCE) behavior and was used to evaluate the effectiveness of the groundwater extraction system at the Site and to evaluate the migration of TCE from actual or potential source areas.

The groundwater flow and the mass transport model calibrated well to existing data suggesting that the model is useful in predicting groundwater flow behavior and simulating the behavior of TCE in the groundwater underlying the Site.

The first mass transport simulation modeled TCE plume behavior from 1973 to 1999 prior to the extraction system start up in 1999. The model started in 1973 because that was the time of the first documented releases at the Site, and the first time that the burial of drums was noted by the regulators. The modeling illustrates that the edge of the groundwater plume moved down gradient of the source areas approximately 515 feet in the first year of travel from 1973 to 1974 as illustrated in Figures 15 and 16 of the Brown and Caldwell report. By 1976 the edge of the plume has moved approximately 1005 feet down gradient of the source areas (Figure 17).

The locations of the first sources to impact the groundwater are unknown. However, the furthest known source areas in the area of the Site buildings are approximately 750 to 850 feet up gradient of the groundwater extraction system. This illustrates that TCE groundwater contamination from the known source areas would travel to and beyond the groundwater extraction system within approximately two years of release. Releases in 1973 would have traveled in the groundwater past the location of the groundwater interceptor trench and extraction wells prior to any alleged releases of wastes generated by Ashland in 1976 and 1977. The organic releases prior to 1976 resulted in the necessity for the groundwater extraction remedy, independent of any alleged releases of wastes generated by Ashland, and whether or not any co-disposal of acid wastes and drums occurred that potentially could have increased the rate of drum degradation.

Opinion 2C. Drum degradation, and release of any contaminants in drummed wastes, would have occurred for most drummed wastes regardless of any potential co-disposal of acids with drummed wastes.

Many acid wastes were disposed of at the Site. Although groundwater data indicate that the extent of acid impact is limited, it is conceivable that co-disposal of acid wastes and drummed wastes occurred. Due to poor waste management practices at the Site, it is also likely (and typical of drum conditions at other similar sites) that many drums were damaged during handling and disposal, if not deliberately emptied. Based on our experience on several Superfund sites drums lose their integrity even if no acid wastes are present. The presence of water (groundwater, infiltration, surface runoff that percolates through the soil etc.) often leads to drum corrosion in time periods of 15 years and perhaps less. The first available data relied upon by Vandeven is from about 15 years after the disposal of spent acid wastes generated by Ashland is alleged to have occurred. Soil and drum removal actions were conducted at the Site in 1992 and 2003, approximately 20 to 30 years after disposal of drums at the Site began. Under natural conditions (where water is present) most drums would have lost their integrity and released their contents, even if no acid wastes have been placed on the site.

We are not aware of any analysis indicating the extent to which Mr. Vandeven believes that the potential increased rate of drum degradation attributable to acid wastes has contributed to the extent of contamination at the Site or associated response costs. Based upon our analysis, it is clear that any accelerated degradation of drums by acid wastes, even if it occurred, could not have affected the extent of groundwater contamination and groundwater response costs. In our opinion, it is unlikely that any potential accelerated degradation of drums by acid wastes, even if it occurred, could have affected the extent of soil contamination and associated response costs.

Summary of Opinion 2: Accelerated degradation of drums due to co-disposal of acid wastes, even if it occurred, did not contribute to response costs, because:

1. The release and transport of the extensive quantities of contaminants disposed of in bulk at the Site could not have been affected by co-disposal of acid wastes and drummed wastes.
2. The extent of groundwater contamination, for both metals and organics, is independent of any alleged disposal of spent acid wastes generated by Ashland, and any other non-metal bearing acid wastes potentially disposed of at the Site in the same timeframe.
3. There is no scientific analysis that we are aware of indicating to what extent accelerated drum degradation, even if it occurred, impacted the extent of soil contamination and associated response costs. Based on drum management practices and the conditions observed at the Site, and our experience of drum degradation at other Sites not impacted by acids, it is our opinion that the extent of soil contamination at the Site at the time response actions were taken was not affected by any potential accelerated degradation of drums attributable to acid wastes.

Opinion 3: The alleged disposal of non-metal bearing acid wastes at the Site in or subsequent to August 1976 did not contribute to the environmental conditions that lead to soil remediation response actions in Operable Unit #2 (OU2).

Opinion 3A. The alleged locations of disposal of spent acid wastes generated by Ashland could not have impacted the areas addressed in OU2 soil remediation response areas.

Three hot spots were identified at the Site during the Remedial Investigation (RI) (CH2M HILL, 1997a). The remediation of these hot spots is one of the components of the selected remedy in the US Environmental Protection Agency (EPA) Record of Decision (ROD) (US EPA, 1998b). The locations of the hot spots are identified in Figure 1-8 of the Feasibility Study (CH2M HILL, 1997b) and in Figure 7 of the ROD. These areas were addressed as Soil Remedy Areas #1 and #2 (SR 1 and SR 2) during implementation of the response actions for OU2 (Brown and Caldwell, 2004a).

Two former employees of Boarhead Corporation have identified the locations of the alleged discharge of Ashland spent acid on the site. Mr. Jeffrey Shaak testified in 2003 (Shaak, 2003) that he may have released 3 or 4 loads of Ashland spent acid in the open field and the swamp. Mr. Shaak drew these locations on a Site map, which was recorded as exhibit P-62 and dated 6/4/03. Mr. Manfred DeRewal, Jr. testified in 2003 (DeRewal, Jr., 2003) that he may have released 8 to 15 loads of Ashland spent acid by the edge of the small pond in front of the office at Boarhead Farms. Mr. DeRewal pointed out the location on a site map, which was recorded as exhibit P-8 and dated 5/7/03. This was the same location that in earlier testimony Mr. DeRewal identified as the location he released Diaz Chemical Corporation waste. Both men said that small pits or holes were dug and the waste was allowed to infiltrate into the ground.

The release of any spent acid generated by Ashland in the locations identified by the former Boarhead Farms employees could not have contributed to the contamination at Hot Spots 2 and 3 because all three reported spent acid release locations are down gradient topographically and hydrogeologically from the two Hot Spots. The following approximate surface elevation ranges were obtained from Figure 1-8 in the Feasibility Study (FS) (CH2M HILL, 1997b).

<u>Area</u>	<u>Elevation (feet above MSL)</u>
Hot Spot 2	578-588
Hot Spot 3	594-600
Release near pond	570-574
Release in open field	566-574
Release in swamp	545-556

Groundwater elevations of the overburden and shallow bedrock wells were taken on four occasions between 8/13/93 and 7/27/95. The potentiometric surface maps developed from these groundwater elevations are presented in the RI (CH2M HILL, 1997a). The maps illustrate that the release areas are all down gradient of Hot Spots 2 and 3. Groundwater in the release areas is moving away from the Hot Spot areas 2 and 3 in an easterly direction. Therefore, there is no physical means for the alleged releases of spent acid wastes generated by Ashland to impact Hot Spots 2 and 3 either running along the ground surface or moving with the groundwater flow.

Hot Spot 1 is located approximately 600 feet north of the alleged release areas. Hot Spot 1 is side gradient of the release areas hydrogeologically. The direction of groundwater flow in the

area of Hot Spot 1 is different than that observed in the release areas. The potentiometric surface maps from the RI (CH2M HILL, 1997a) illustrate that the groundwater in the release areas moves in an easterly direction while the groundwater in the area of Hot Spot 1 moves in a northerly direction. Groundwater in the area of the releases will not move toward Hot Spot 1.

Opinion 3B. Spent acid generated by Ashland did not contain contaminants in concentration or type that could have contributed to the soil remediation response actions at OU2.

The hot spot areas comprising OU2 contained high levels of volatile organic compounds (VOCs). According to the FS Section 1.4.5 (CH2M HILL, 1997b), Hot Spot 1 "showed high levels of TCE, 1,1,1-TCA, cis-1,2-DCE, 1,2-DCA, and vinyl chloride". Hot Spot 3 "showed high levels of TCE, 1,1,1-TCA, cis-1,2-DCE, and 1,2-DCA". The compounds driving response actions at these locations are all chlorinated solvents and their degradation products. There is no evidence that Ashland wastes allegedly disposed of at the Site contained these compounds. (Curley, 1996, 2004).

According to the FS, Hot Spot 2 contained high concentrations of benzene. Ashland used benzene in some of its processes. However, there is no evidence that Ashland's solvent wastes were disposed of at the Site. The testimony of Arthur Curley (Curley, 2004) of Ashland explicitly addressed this issue. Mr. Curley testified to the following:

1. Spent benzene and spent toluene had a separate tank, and were not mixed with other wastes (p. 66)
2. For a brief time, benzene, toluene and xylene wastes were blended and burned as boiler fuel, but other than that, have always gone off-site for incineration. (p. 85)
3. Mr. DeRewal did not handle Ashland's solvent waste. (p. 145)

We are not aware of any records or testimony that contradicts this testimony.

The Remedial Construction Report for OU2 (Brown and Caldwell, 2004a) documented that the limits of excavation for soil hot spot removal actions were based exclusively on concentrations of TCE and benzene.

Summary of Opinion 3: Spent acid wastes generated by Ashland could not have contributed to the soil remediation costs in OU2 because:

1. Spent acid wastes generated by Ashland, if any, were disposed of in areas down gradient or side-gradient of the soil response areas, and could not have impacted these areas.
2. Soil response actions targeted volatile organic compounds (TCE and benzene) from waste solvents. Ashland's solvent wastes were not disposed of at the Site.

3.0 Qualifications

W. Leigh Short, PhD, PE

Dr. Short has thirty-five years of experience in industry, consulting, and university teaching. He has developed a broad range of technical, project management, and business management experience. He received BS and MS degrees in Chemical Engineering from the University of Alberta, and a PhD in Chemical Engineering for the University of Michigan. He worked as a process engineer from 1957 to 1967 for Canadian Industries, Ltd. and Chevron Research. From 1967 to 1979, he was a professor at the University of Massachusetts, where he served as Department Head in Chemical Engineering. He has worked as a consultant in hazardous waste management and air pollution control since 1979, and has been a principal of Alternative Environmental Strategies, LLC since 1999.

Dr. Short has participated in numerous expert panels, including the technology panel of EPA's Science Advisory Board and EPA's SBIR and research grant's review panels. He serves as a member of the National Research Council "Stockpile" committee (chemical weapons disposal) since 1999, where he has served as chair of the monitoring, safety and risk subcommittee. He was a Member of the National Research Council "Chemical Events" committee, which is conducting an analysis leaks of chemical agents. He has served as a consultant to the National Academy of Engineering on flue gas desulfurization (1975), and as a corresponding member of the EPA panel to review sludge regulations.

Dr. Short has presented expert witness testimony at numerous sites involving hazardous wastes and Superfund cost allocation and cost recovery. These have included:

- Superfund cost allocation for various sites, including pharmaceutical wastes, combined industrial and municipal wastes, PAHs and coal tars, mixed septage and liquid chemical wastes, VOCs, metals, and PCBs.
- At a former dioxin site, he provided testimony related to past operating practices and their relationship to spill patterns existing in the site.
- He has developed expert witness testimony in insurance cost recovery cases. The testimony discussed remedial action costs, including installation and long-term operating costs.

His compensation in this matter is \$175/hour, and \$300/hour for testimony.

James F. Roetzer, PhD

Dr. Roetzer has performed numerous investigations of the fate and effects of chemicals in various environmental settings, including air, water, soil and solid waste. He has performed studies and managed projects for utility, industrial and government clients. He is currently a principal of Alternative Environmental Strategies. He received a BS degree in Chemistry (cum laude), and MS and PhD degrees in Environmental Engineering from Rensselaer Polytechnic Institute. He worked at Woodward-Clyde Consultants from 1983 to 1986, where he was

responsible for managing the Chemistry/Chemical Engineering group and served as a practice leader in risk assessment. He worked for Envirosphere Company from 1978 to 1973, where he led the Environmental Chemistry and Health Group.

He has managed RI/FS studies for industrial, manufacturing and utility clients under state and federal programs and has provided external peer review of projects performed by agencies and other consultants. He has provided expert testimony regarding the environmental chemistry of heavy metals at facility licensing hearings, and expert testimony and expert reports related to contaminant distribution, impacts, and cost allocation at several contaminated sites, including two Superfund sites in New Jersey and an oilfield site in Arkansas.

His compensation in this matter is \$175/hour, and \$300/hour for testimony.

Gordon Jamieson, PG

Mr. Jamieson is the National Geosciences Discipline Leader at Tetra Tech EC. He is responsible for the training, quality of work and overall administration of over 80 Geologists, Hydrogeologists and Geophysicists in ten offices across the United States. In addition Mr. Jamieson is a principal in Alternative Environmental Strategies, LLC, and does independent consulting (including expert witness work) through them.

He received his Bachelor of Science Degree in Geology from the University of Waterloo in 1979 where John Cherry developed his interest in hydrogeology, and his Masters of Science in Hydrogeology from the University of British Columbia under Allan Freeze. Tetra Tech EC has employed him since 2000. He was employed by Woodward Clyde (now URS) from 1990 to 2000.

His academic training and professional experience has been in contaminant hydrogeology. He has been involved in the characterization and remediation of numerous sites throughout the United States and Canada. He has managed the remediation of various industrial, USEPA and United States Department of Defense sites across the country.

His compensation in this matter is \$175/hour, and \$300/hour for testimony.

4.0 Documents Considered In Forming Opinions

Agency for Toxic Disease Registry and Disease Registry (ATSDR). 1992. Toxicological Profile for Thallium. July.

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Brown and Caldwell. 2004b. Boarhead Farms Superfund Site, Operable Unit No. 1, Groundwater Model Report (Draft). October.

Bucks County Department of Health (“BCDH”) Waste Characterization Reports.

BCDH Field Reports.

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ATTACHMENT A

CURRICULA VITAE

Alternative Environmental Strategies, LLC

Environmental Management and Consulting

W. Leigh Short, Ph.D., P.E.

EDUCATION

Ph.D., Chemical Engineering, University of Michigan, 1962

M.S., Chemical Engineering, University of Alberta, 1957

B.S., Chemical Engineering, University of Alberta, 1956

REGISTRATION

Professional Engineer: Texas, 1984

PROFESSIONAL HISTORY

Alternative Environmental Strategies, 1996-present

Woodward-Clyde Consultants, Principal and Vice President, 1987 to 1996

Radian Corporation, Senior Program Manager, 1985-1987

Environmental Research and Technology, Vice President, 1979-1985

University of Massachusetts, Professor/ Department Head Chemical Engineering, 1967-1979

Chevron Research Company, Senior Process Engineer, 1962-1967

Canadian Industries Limited, Project Engineer, 1957-1959

REPRESENTATIVE EXPERIENCE

Dr. Short has thirty-five years of experience in industry, consulting, and university teaching. He has developed a broad range of technical, project management, and business management experience.

Hazardous Waste Management

Dr. Short directed a focused feasibility study as part of an IRM to remove 17,000 cubic yards of tar byproduct from the former Paterson Gas Works site (Public Service Electric & Gas Company, Newark, NJ). As a part of this feasibility study the major technologies investigated were:

- incineration
- thermal desorption
- bioremediation
- solvent washing/solvent flushing

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W. Leigh Short, Ph.D., P.E.

Dr. Short directed a site investigation at a municipal landfill for the City of New York DOS and DEP. Activities included sampling air, surface and subsurface soil, leachate, surface water, groundwater, and biota. A wetland assessment, dye tracer and salinity gradient studies in the adjacent bay, and a risk assessment were also performed.

Dr. Short was the manager of treatability studies to evaluate various methods of treating soils containing large quantities of PCBs and phthalates. Five separate on-site consultants were used to perform the work. The data was used to evaluate the need for further, field scale, pilot plant studies and to provide input to a remedial alternative analysis.

He directed a feasibility study (FS) for a Superfund site in northwestern New Jersey (commercial client). The FS has been accepted by EPA and NJDEPE, and a record of decision has been issued. The site contained paint sludges and was an abandoned mine operation.

He was responsible for preparation of an RI/FS for conversion of a PCB contaminated building and associated property to a residential area.

He has developed cleanup strategies for numerous contaminated sites including rail yards, oil storage facilities, former manufacturing facilities, operating facilities, and PCB-contaminated sediment. Additionally, Dr. Short has been responsible for the peer review of a significant number of ECRA (now ISRA) submissions to NJDEPE, treatability programs, and RCRA remediation designs.

He has worked on remediation projects for a wide variety of hazardous waste sites, including petroleum contaminated sites, dioxin sites and chemical manufacturing generally. He has supervised several "due diligence audits" for possible environmental issues associated with acquisitions/mergers. While at Woodward Clyde he was the engineer responsible for the design/installation of processes for the remediation of a manufactured gas plant site and a chemical site.

Manufactured Gas Plants

Dr. Short was responsible for an extensive analysis of remedial technologies applicable to MGP sites, with particular emphasis on innovative and developing technologies for treatment of contaminated soil. He managed the design of the wastewater treatment system at a major MGP site in northern New Jersey. The processes used are dissolved air flotation and CFBR. The water potentially contains LNAPL, DNAPL and emulsions. The major organic contaminants are benzene, naphthalene and multi ring PAHs.

He has provided technical support to a west coast consulting firm in a lawsuit concerning one of their clients. The chemicals at issue were heavy organics (PAHs) and coal tar derivatives. The case concerned cost allocation to the various parties involved.

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Air Pollution Control

Dr. Short's air pollution experience includes teaching of courses in control technologies while at University of Massachusetts, both to graduate students and as a part of EPA's national training programs. He also served as chairman of the NOx control technology review panel for EPA. His project management experience for air related projects includes:

- Consultant to EPA (Research Triangle Park) for several years (1973-1979) assisting them in the management of Radian's contract to measure fugitive emissions from refineries and develop productive techniques for control measures. Dr. Short was responsible for critique of the program sampling methods, statistical methods, etc., and for assisting EPA and API in the selection of the representative refineries.
- Direction of the EPA program to measure and predict fugitive emissions in petroleum refineries.
- Project Director for a PSD application for expansion of Texaco's Port Arthur refinery.

He is also the author of a chapter entitled "Air Pollution Control in Petroleum Refineries", in the Handbook of Air Pollution.

Process Engineering

During his employment at Chevron Research, he worked in the development, design, construction, and startup of a novel wastewater treatment process for Chevron. This resulted in several patents and the process is licensed by Chevron worldwide. He also was responsible for the preparation of the process section of the bid specification of a solvent deasphalting plant, and served as the Chevron process representative in the offices of M.W. Kellogg during the design of this facility. After construction, he prepared operator training manuals and served on the startup team.

As a part of the licensing process for Dow's Aquadetox process, Dr. Short directed a state-of-the-art review of technologies for industrial wastewater treatment.

He was also project manager responsible for the preparation of specifications and the procurement of necessary contractors for the dismantling of a refinery, and project manager of an environmental impact/permitting study for the modification of a large Gulf Coast refinery. He served as a project engineer managing plant construction projects, and was responsible for the design of high pressure heat-exchange equipment.

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W. Leigh Short, Ph.D., P.E.

He was active in projects to determine the cost to the petroleum industry of removing sulfur from gasoline and diesel fuel, the impact on the California petroleum industry of processing Alaskan crude oil, and evaluation of various technologies capable of meeting BAT regulations in the plastics and petrochemical industries.

He developed a feasibility study of possible water treatment techniques to allow a waste to energy conversion plant to meet its discharge permits.

As a consultant to Arthur D. Little (1975 and 1976), Dr. Short worked on a project to develop linear programming methods to simulate "model petroleum refineries" for the United States. These models were used to assess the impact on the petroleum industry of lead removal from gasoline (and later sulfur removal from diesel fuels and catalytic cracker feed or effluents).

Dr. Short was project director for an API project to monitor the effluent guidelines work done by EPA. He also served in a similar peer review role for water modeling work done for API and for a BAT study done for the steel industry on waste treatment and wastewater loads (allocations).

EXPERT TESTIMONY

Dr. Short has presented expert witness testimony, prepared expert reports or given depositions for approximately 20 sites involving hazardous wastes and Superfund cost allocation and cost recovery. These have included:

- Superfund cost allocation for various sites, including pharmaceutical wastes, combined industrial and municipal wastes, PAHs and coal tars, mixed septage and liquid chemical wastes, VOCs, metals, and PCBs.
- At a former dioxin site, he provided testimony related to past operating practices and their relationship to spill patterns existing in the site.
- He has developed expert witness testimony in insurance cost recovery cases. The testimony discussed remedial action costs, including installation and long-term operating costs.

He has also given testimony before the California Air Resources Board and chaired an EPA hearing for the Science Advisory Board.

EXPERT PANELS

During 1975-1980, Dr. Short was a member of the technology panel of EPA's Science Advisory Board and has continues to be a member of EPA's SBIR and research grant's review panels. As a member of these panels, he helped evaluate new treatment technologies (BAT) and provided recommendations for the funding of new research areas.

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He served as a member of a peer review panel of EPA center of excellence in petroleum production environmental issues. (2002)

He was a member of the National Research Council "Stockpile" committee (chemical weapons disposal) since 1999. He was a Member of the National Research Council "Chemical Events" committee. This committee is conducting an analysis of all leaks of chemical agent that have occurred during destruction activities at JACADS and TOCDF. He served as chair of the monitoring, safety and risk subcommittee of the stockpile committee.

He has served as a consultant to the National Academy of Engineering on flue gas desulfurization (1975), and as a corresponding member of the EPA panel to review the new sludge regulations.

Since 1999 he has been a member of the National Research Council Stockpile Committee, which is an oversight committee for the destruction of chemical weapons by the Army. In 2005 he left this committee to become a consultant to SAIC (the Army contractor) also for work associated with the destruction of chemical weapons. He was a member of the NRC committee that investigated the release of a small quantity of agent at TOCDF (Tooele Utah).

PROFESSIONAL ORGANIZATIONS

American Chemical Society

American Institute of Chemical Engineers

U. S. Environmental Protection Agency

- Science Advisory Board, Member 1974-1980
- Grants Peer Review Committee
- Review Panel for Small Business Innovative Research Programs

Member AIChE and EAC Accreditation Committee for Chemical Engineering Programs and program evaluator for chemical engineering

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Environmental Management and Consulting

James F. Roetzer, Ph.D.

EDUCATION

Ph.D., Rensselaer Polytechnic Institute, 1978, Environmental Engineering
M.S., Rensselaer Polytechnic Institute, 1973, Environmental Engineering
B.S., (cum laude), Rensselaer Polytechnic Institute, 1971, Chemistry

PROFESSIONAL HISTORY

Alternative Environmental Strategies, 1996-present
Woodward-Clyde Consultants, Senior Consultant, 1983-1996
Envirosphere Company, Division of Ebasco Services, Inc., Principal Environmental Chemist,
1978-1983

REPRESENTATIVE EXPERIENCE

Dr. Roetzer has performed numerous investigations of the fate and effects of chemicals in various environmental settings, including air, water, soil and solid waste. He has performed studies and managed projects for utility, industrial and government clients. He is currently a principal of Alternative Environmental Strategies. At Woodward-Clyde, he was responsible for managing the Western New York office and the Chemistry/Chemical Engineering group in the Wayne, New Jersey office, and he served as a practice leader in risk assessment. He led Envirosphere's Environmental Chemistry and Health Group in New York City.

Hazardous Waste Management

Dr. Roetzer has managed RI/FS studies for industrial, manufacturing and utility clients under state and federal programs and has provided external peer review of projects performed by agencies and other consultants. He has served as project manager for RI/FS studies at several manufactured gas plant (MGP) sites; Superfund sites contaminated by solvents, PCBs and waste oils; and manufacturing sites and warehouse facilities contaminated by surfactants. He has conducted studies of many industrial sites subject to New Jersey's ECRA/ISRA program, and managed a program cited as a model by NJDEP. He has managed site remediation projects involving groundwater treatment, soil removal, thermal treatment, soil/waste recycling, and building decontamination. Dr. Roetzer has performed investigation and remediation of numerous contaminated sites in New York and New Jersey. He has conducted RI/FS studies at several former MGP sites in New York and New Jersey including development of a cost-effective risk assessment strategy for a major MGP site. He is currently managing a RCRA Corrective Action program at a former pesticide formulating facility in Maryland, and recently completed a feasibility study and remedial action workplan

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James F. Roetzer, Ph.D.

for remediation of a major chemical plant in New Jersey. He has recently provided expert testimony and litigation support services for two Superfund sites in New Jersey.

Risk Assessment

Dr. Roetzer has served as a practice leader in risk assessment, and has been responsible for risk assessments conducted for municipal landfills, MGP sites, and numerous Superfund and RCRA sites contaminated by solvents, oils, metals, pesticides, and other wastes. These assessments have included all aspects of multimedia exposure and risk analysis, full baseline risk assessments, and determination of site-specific remediation standards. In addition to routine soil and groundwater exposure analyses, his work has included evaluations of migration of DNAPL in a complex fractured bedrock hydrogeologic system; volatilization and airborne transport; and modeling surface water impacts. He has successfully negotiated alternate cleanup levels, including standards for petroleum hydrocarbons. He has also been responsible for assessing potential health impacts from development of coal gasification and other synfuels technologies, considering air, water, and waste-related impacts. He has recently completed work in evaluating indoor air impacts from a major underground fuel leak, and is currently managing risk assessment work, including development of alternate cleanup levels, for a pesticide formulating facility undergoing RCRA Corrective Action, considering potential threats to human health, ecological resources and groundwater. He has conducted risk analyses in New York State for chemical plants, manufacturing facilities, PCB sites, and manufactured gas plant (MGP) sites.

Manufactured Gas Plants

Dr. Roetzer has extensive experience with manufactured gas plant (MGP) sites, including RI/FS work, risk assessment, treatability studies, and air monitoring. He has conducted RI/FS studies at several former MGP sites in New York and New Jersey. He has developed a cost-effective risk assessment strategy for a major MGP site in northern New Jersey. He has assisted in developing a community risk communication program at another MGP site in New Jersey. He has evaluated potential surface water impacts and risks associated with several MGP sites in New York and New Jersey. He has developed and implemented an air monitoring program at a New York MGP site. He has conducted risk assessment and treatability studies for MGP sites in New Jersey.

Environmental Chemistry – Fate and Transport

Dr. Roetzer has conducted numerous evaluations of the fate and transport of chemicals in environmental settings. His graduate research studied adsorption/ desorption and transport of inorganic chemicals in sediments. He has participated in fate and transport modeling of organic and inorganic chemicals in various environmental media, including soils, surface water, groundwater, and air. He has evaluated the complexation and immobilization of metals in discharges and aquatic systems. He has managed laboratory studies of adsorption/

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James F. Roetzer, Ph.D.

desorption and degradation of organic chemicals, including polycyclic aromatic hydrocarbons and pesticides. He has supervised environmental laboratory QA/QC programs, including laboratory audits and data validation. He is currently serving as program manager for analytical data quality management for the corporate environmental group of a major chemical company.

Litigation Support and Expert Testimony

Dr. Roetzer has provided technical support for litigation concerning past disposal practices at Superfund sites and industrial facilities, including chemical manufacturing, tool manufacturing, asphalt product formulating, aluminum manufacturing, and pesticide formulation facilities. Key issues addressed have included dating contamination, evaluating remediation needs and costs, and identifying applicable regulatory requirements. He has prepared several expert reports and provided depositions and extensive expert testimony regarding allocation of remediation costs and potential for facilitated transport at two Superfund sites in New Jersey. He has also prepared expert reports in support of cost allocation litigation for several other Superfund sites. He has presented oral depositions related to insurance settlements and cost recovery at contaminated sites. He has presented expert testimony concerning the environmental fate of heavy metals at NPDES hearings and ash landfill licensing hearings. He has developed technical "white papers" concerning proposed environmental regulations and test procedures in support of litigation. He recently provided testimony concerning potential for Imminent and Substantial Endangerment related to petroleum production wastes at a site in Arkansas.

Facility Decommissioning

Dr. Roetzer has managed all environmental aspects associated with decommissioning of a major (14 city block) soap, detergent and personal care product manufacturing facility. This project included conducting an extensive soil and groundwater monitoring program, and a detailed survey of the facility for the presence of hazardous materials, including PCBs, asbestos, radiation sources, and other hazardous industrial materials. The remediation was cited by the lead agency as a model program.

Property Transfers

Dr. Roetzer has performed and managed Phase I and Phase II Environmental Site Assessments related to property transfers, and has managed nationwide programs associated with mergers and acquisitions. He has served on an expert panel evaluating potential environmental liabilities at numerous chemical plants and Superfund sites. He has applied innovative decision analysis and probabilistic methods to evaluating environmental liabilities, and has led workshops designed to reconcile disparities in buyer and seller estimates of potential liabilities.

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James F. Roetzer, Ph.D.

Environmental Compliance

Dr. Roetzer was responsible for a variety of environmental compliance activities at several North American facilities for a major international automotive parts manufacturing company. Activities included environmental compliance audits, investigations and remediation of soil and groundwater contamination, and permit assistance, at U.S. and Canadian facilities. He has also managed compliance activities related to groundwater remediation for a major chemical manufacturer, including water quality evaluations and discharge and emission monitoring. Dr. Roetzer has developed RCRA Part B permit applications for industrial waste treatment and storage facilities, and NPDES/SPDES applications for power plants and manufacturing facilities.

Environmental Impact Evaluations

Dr. Roetzer has conducted numerous evaluations of the environmental and health hazards associated with existing and proposed power plants, industrial facilities and waste disposal facilities. He has developed water quality impact evaluations for Environmental Impact Statements. He was responsible for developing engineering reports for waste handling and material and waste handling systems for proposed facilities. He has worked with the utility industry's Utilities Solid Waste Activities Group in evaluating the impact of RCRA regulations on the utility industry.

Innovative Treatment

Dr. Roetzer has managed projects involving innovative treatment methods for contaminated sites, including laboratory and field pilot testing of chemical and biological methods for in-situ treatment of soils contaminated by hydrocarbons, PAHs, pesticides and PCBs. He has also been responsible for developing field screening tests, including PCB test kit applications, UV-fluorescence screening and hydrocarbon screening analyses. Dr. Roetzer was a principal author of a critical review of the state-of-the-art of in-situ treatment methods for hazardous wastes prepared for the USEPA. He has also been responsible for research into potential use of pozzolanic waste products as landfill liner materials. He has served as an external peer reviewer on several USEPA panels reviewing grant applications for innovative hazardous waste treatment research.

PROFESSIONAL ORGANIZATIONS

American Chemical Society

Society of Sigma Xi

Air and Waste Management Association

USEPA Hazardous Waste Research Grant Programs - External Peer Reviewer

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Gordon R. Jamieson, PG

EDUCATION

MS, Hydrogeology, University of British Columbia, 1981
BS, Earth Science, University of Waterloo, 1979

REGISTRATIONS/CERTIFICATIONS

Professional Geologist, (PG), Geology, Alberta, Canada, M35949, 9/28/82, 12/31/05
Certified Professional Geologist (CPG) Geology, US, 10602, 12/31/05
Professional Geologist (PG), Hydrogeology, WA, 2182, 10/31/05

REPRESENTATIVE EXPERIENCE

Mr. Jamieson is the National Geosciences Discipline Leader for the TtEC, a partner in Alternative Environmental Strategies, LLC and has over 25 years of experience in hydrogeology and geology. He has managed multi-media, multi-disciplinary remedial investigations, feasibility studies, remedial designs and remedial actions. He has been the hydrogeology lead on numerous projects involving DNAPL contamination characterization and remediation including investigation design and implementation, 3-D groundwater modeling, pre-design pump testing and analysis, and groundwater capture system design. In addition, he has been a technical resource and mentor while developing the careers of many associates in multiple offices. As the National Geosciences Discipline Leader, Mr. Jamieson is responsible for over 80 geoscientists administratively and the technical qualifications of the geosciences personnel (geologists, hydrogeologists and geophysicists) and the quality of work products they produce. He is responsible for the proper deployment of geosciences staff on projects, hiring appropriate staff and ensure technical training and mentoring of the geoscientists.

PROJECT EXPERIENCE

Panel Participant

National Center for Environmental Research In 2002

Mr. Jamieson was invited to participate on two expert review panels for the National Center for Environmental Research (NCER), which is a section of the U.S. Environmental Protection Agency's Office of Research and Development. This panel is part of the Science to Achieve Results (STAR) program.

The panels consist of experts from universities, industry and consulting. The panels reviewed proposals for research submitted by researchers in major universities and rank the proposals on their originality, creativity and potential contribution to scientific knowledge. The EPA uses the results from the panels to determine which researchers share in the several million

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dollars in funding.

The first panel that Mr. Jamieson participated in reviewed research proposals on bioremediation and the identification and research of future contaminants not currently on the radar screen but pose a potential hazard. The second panel was on Environmental Futures Research in Nanoscale Science, Engineering and Technology. This panel reviewed over 50 proposals on the Remediation and Treatment area particularly the remediation of soils, sediment and groundwater with respect to heavy metals and organic compounds. Nanotechnology (controlling of structures and devices at the atomic, molecular and supramolecular levels) is an exploding field of research with great promise in many areas. The funding stems from the Nanotechnology Initiative: Leading to the Next Industrial Revolution, a supplement to the President's FY 2001 Budget.

Expert Panel Development and Management

Confidential Client, Venice, Italy

Confidential client has large area of industrial property across the lagoon from Venice. Groundwater contamination is discharging into lagoon. Italian Environmental Ministry wants client to install a 50-mile long, 60-foot deep cut off wall to contain the contamination. Mr. Jamieson has assembled and will be managing a panel of world experts to examine the situation and make recommendations to the client. The panel includes Ghislain de Marsily (France), Giuseppe Gambolati (Italy), David McWhorter (USA) and James Mercer (USA).

Technical Lead

Navy, Moffett Field CERCLA Site, CA

Manage issues related to the Navy's responsibility associated with a large regional TCE groundwater plume. Responsibilities include the development of annual reports, 5-Year reviews, groundwater pump and treat system optimization, long term groundwater monitoring plan, pump testing and analysis, well abandonment. Support the navy at various meetings with the EPA, other responsible parties and the community.

Technical Lead

Roebling Steel Superfund Site, NJ

Manage innovative, state of the art pore water sampling and sampling groundwater discharging to the Delaware River. The technique obtains pore water and pore water as it discharges to a surface water body to determine the actual effect and chemistry of the groundwater when it discharges to the surface water. Determining the impact of metals contaminated groundwater on the near by river.

Technical Oversight

PADEP, Baghurst Alley Remedial Investigation, PA

Technical oversight and strategy development for the investigation and characterization of a TCE groundwater plume. Oversight of the initial investigation strategy and review and

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interpretation of the results. Developed of a state of the art multi-level monitoring system for further delineation and cost savings to PADEP.

Groundwater Modeling Oversight

PADEP, Blue Bell Gulf Station Remedial Design, PA

Developed a 3D groundwater flow model and particle tracking to design a groundwater remediation system for the capture of a MTBE and BTEX plume. After the completion of a pumping test the groundwater modeling was used to determine the optimal number location and pumping rate of each of the recovery wells.

Technical Lead

Former Manufactured Gas Plant Site, Hackensack, New Jersey

Technical oversight or Investigation and characterization of DNAPL contamination at former manufactured gas plant site. Investigation included barge work in a river and pore water sampling of sediments and natural formation below the River. In addition, a 3-D visualization model (EVS) of the stratigraphy and DNAPL distribution beneath the site was developed to convince and illustrate to the regulators that the DNAPL from the site was not impacting an off-site contaminated property. 3-D visualization is a very innovative and valuable tool for site characterizations and regulator negotiations.

Groundwater Remediation Modeling Oversight

Former Manufactured Gas Plant Site, Coney Island, New York

Managed the modeling of remediation design for groundwater and source material at former manufactured gas plant site. Simulated cutoff walls, diversion trenches, capping and pumping wells to optimize the design and determine the minimum pumping rates required for groundwater control under a cap to contain DNAPL impacted soil.

Remediation Modeling Oversight

Former Manufactured Gas Plant Site, Glens Falls, New York

Managed the modeling of remediation of a former manufactured gas plant site. Remediation includes source removal, stabilization of soil contamination under a sub-station, source area containment and groundwater treatment with a funnel and gate system and capping. Modeling performed to design the proper funnel and gate4 system to avoid groundwater mounding and design proper treatment of the impacted groundwater.

Technical Lead

Rho Refinery, Milan, Italy

Managed the modeling of a groundwater pump and treat containment system required to capture a groundwater contaminant plume prior to leaving the site. A 3 dimensional groundwater flow model was developed to determine the number of wells and the pumping rates required to capture a groundwater contaminant plume at the refinery site. The site is being redeveloped into world fair grounds. The future installation of a subway tunnel immediate down gradient and public water supply wells down gradient of the site further complicated the modeling effort. One hundred percent groundwater capture was required by

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Gordon R. Jamieson, PG

the contract with the client. We also designed the nine recovery wells and assisted the Milan office with technical direction with respect to drilling and installation methods, and development. The wells have the capability to pump 2,700 gallons per minute.

Technical Lead

Wyeth Facility, Buenos Aires, Argentina

Performed site visit and reviewed the data for a pump and treat system, installed by others, to determine if the groundwater capture portion of the system was containing the contamination on site. The capture system consisted of 5 pumping wells and 8 re-injection wells. Analysis of the data indicated errors in the initial pump tests and subsequent capture modeling. The system is currently being reevaluated to determine the modifications needed to attain capture.

Groundwater Modeling Lead

Roebling Steel Superfund Site, NJ

Development of a groundwater flow and transport model as part of a feasibility study (FS) to simulate the current conditions and remedial options for Lead, Arsenic and Beryllium groundwater contamination. The site is located next to the Delaware River and the concern is the transport of the metals contamination to the surface water body and sediments. The modeling illustrated that the metals contamination in the groundwater would not reach the river but could not be remediated using a pump and treat system. It would take over 70,000 years to remediate the groundwater under the pump and treat scenario. The modeling was performed on a fast track with meeting every 2 weeks with the EPA to get their approval throughout the development. This expedited the approval process. The EPA had no comments on the modeling component of the FS after submission of the draft FS.

Groundwater Modeling Oversight

Holloman Air force Base, NM

Development of a 3D, 3 phase (air, water and product) transport model to optimize a remedial system of over 100 extraction and injection wells. The model was calibrated to the existing well system and was used to predict future flow patterns of product, water and air under various pumping and well placement scenarios. The time needed to reach clean up goals was also developed for the client to assist in proper funding for the project in the future.

Remedial Investigation Technical Lead

Lehigh Superfund Site, NY

Developed a groundwater investigation to determine the nature and extent of the largest TCE plume in New York State. The plume is approximately six miles long and two miles wide caused by the derailment of two tanker cars containing TCE in the 1970s. The plume entered a fractured limestone aquifer and has moved and is discharging into a creek six miles down gradient of the site. Through the use of existing data from previous work, contaminated home wells in the plume and strategically placed monitoring wells the extent and impact of the TCE plume will be assessed and remedial options developed in the FS.

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Environmental Management and Consulting

Gordon R. Jamieson, PG

Chemical/Pharmaceutical Group Leader, Principal Hydrogeologist and Project Manager- URS (formerly Woodward Clyde) (1990-2000)

Technical lead and oversight on numerous RI and remediation projects throughout the eastern United States. Worked with personnel in a dozen different offices on groundwater and soil contamination projects. Directed the planning, staffing and execution of dozens of projects. Scope of responsibilities includes project management, technical support; negotiations with regulators, staffing deployment, meeting billability goals, chemical/pharmaceutical sector marketing and staff management. Managed a staff of up to 15 through three supervisors.

W. R. Grace, Fords, NJ,

Managed multi-disciplinary, multi-media Remedial Investigation/Remedial Action Work Plan at active facility in New Jersey. Characterized PCB contamination in soils, sediments, LNAPL, former lagoons and groundwater. Performed a treatability study to evaluate various soil treatment technologies including stabilization, thermal desorption and bioremediation. Managed the development of a Human Health Risk Assessment, an Ecological Evaluation and a Feasibility Study. Developed Remedial Action Plan, which includes capping, stabilization, sediment removal, LNAPL removal and natural remediation of groundwater.

Ashland Chemical, Amenia Landfill Superfund Site, Amenia, NY

Managed a drum disposal and RI/FS at Superfund landfill in New York State. Disposed of over 150 buried drums, negotiations with regulators, and Multi-media RI/FS work plan development. The site has PCB and volatile organic contamination. Other PRPs included Novartis, Unisys and Dow Corning.

Former PSEG Manufactured Gas Plant, Paterson, NJ,

Performed the contaminant hydrogeology evaluations at a former manufactured gas plant. The site contained DNAPL and associated dissolved contamination in the overburden and fractured rock. Recruited and worked with Dr. John Cherry, Dr. David McWhorter and Dr. Ray Loehr on the project to develop an appropriate design for all media and obtain NJDEP approval. Activities included developing a site conceptual model, oriented coring and dominant fracture mapping, designing and implementing a site characterization, 3-D groundwater modeling, pre-design pump testing and analysis, and groundwater capture system design.

Picillo Farms Superfund Site, RI

Evaluated the groundwater contamination distribution in an overburden and bedrock aquifer and the design of a groundwater containment system. Negotiations with EPA Region 1 and coordination with soil vapor extraction and groundwater treatment system design. Major PRPs clients included Ashland Chemical, GE, American Home Products and GAF.

ITT Industries, Nutley, NJ

Managed the investigation and remediation of soil, sludge and groundwater contamination at a former manufacturing and research facility. Designed and performed soil and groundwater

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contamination investigation and characterization. Identified a single source of TCE contamination in groundwater, which was a former settling tank. Removed underground concrete tank, sludge and surrounding soils. Applied for, negotiated and obtained a no further action from the NJDEP along with an approved natural remediation approach to the groundwater contamination.

Ciba Geigy RCRA Corrective Action, Cranston, RI

Performed groundwater contaminant transport modeling to determine the flux of contaminants moving off the former Ciba Geigy facility and discharging into the adjacent river. The modeling illustrated an unacceptable amount of flux to the river. Performed groundwater capture modeling to determine the number, location and pumping rates of recovery wells needed to capture the groundwater prior to discharging into the river. Designed the pumping wells and oversaw the installation of the wells and the startup of the system. Successful capture of the contaminant plume was attained.

Former PSEG Manufactured Gas Plant, Bayonne, NJ

Developed groundwater conceptual model for the distribution and movement of contaminated groundwater at the site. Determined that the coarse backfill in a large sewer line was acting as a groundwater sink for the site groundwater. Through the use of groundwater modeling and active negotiations convinced the NJDEP that active control and remediation of the groundwater was not required if source materials were removed.

Groundwater Modeling Oversight, Various Locations,

Performed groundwater-modeling oversight for numerous projects and numerous offices throughout the eastern United States. Activities included: developing conceptual model, determining appropriate boundary conditions, peer reviewing results, trouble shooting, presentations to clients and regulators, report writing, peer review and negotiations with regulators. Clients included Pfizer, Boeing, EPA, Roman Haas, ITT Industries, Dupont, PP&L, Clorox and others.

Corporate Technical Director, Vectre Corporation (1984-1990)

Managed a group of 15 professionals performing Remedial Investigations/Remediation and UST testing and closures in New Jersey, Pennsylvania and Massachusetts. Scope of activities included direct P&L responsibilities to the President, QA/QC of all documents developed, technical support and guidance, manage and assist marketing team, all aspects of staff management and monthly reports to the President.

Unisys Corporation, Sudbury, MA

Determined the extent of two TCE groundwater plumes on a former research facility. One plume was emanating from a septic system and the other from a former release to a gravel pit. One plume was located in the town of Sudbury and the other was in the town of Concord within 1500 feet of a town water supply well. Developed and negotiated a remediation strategy with the MADEP, the town of Sudbury and the town of Concord. Designed a

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groundwater pump and treat system (air stripping), developed bid documents, performed construction oversight, startup and O & M.

Ames Rubber Corporation, Hamburg, NJ

Delineated the extent of a TCE groundwater plume in overburden and fractured bedrock emanating from a manufacturing facility. The plume was discharging into a major river at the edge of the facility. Performed pump tests and designed a groundwater capture system. Negotiated final remediation with the NJDEP. Managed treatment system design and construction oversight. Obtained all NJDEP permits and approvals.

Hydrogeologist and Project Manager, Groundwater/Technology and Hardy Associates

Conducted various remedial investigations, groundwater modeling and water supply projects including project management.

Bayer Corporation, Charleston, SC

Performed treatability pilot study in a 20-acre sludge lagoon at a pigment facility. Installed and ran a vacuum point dewatering system in a corner of the sludge lagoon to determine if vacuum point dewatering of the sludge was feasible for lagoon closure requirements. Measured water removal volumes, sludge consolidation and sludge water content reduction. Submitted report on pilot results.

Owen-Illinois, Alton, IL and Bridgeton, NJ

Designed and conducted soil and groundwater investigation at the company's two oldest glass-manufacturing facilities in the country. Both facilities closed and both had on-site landfills with up to 100 years of activity. Both facilities were adjacent to a major river. The Alton facility was next to the Mississippi. Metals contamination was found from historic glass manufacturing methods.

Uniroyal Corporation, Edmonton, Alberta, Canada

Designed and implemented groundwater contamination investigation and remediation. Facility produced 2,4,5T and 2,4D pesticides prior to the banning of the production of these chemicals. Waste liquids were stored in two unlined lagoons. Performed a groundwater investigation and determined the extent of the contaminant plumes traveling from the lagoons. Conducted pump tests to determine the hydraulic characteristics of the aquifer. Developed and ran a groundwater model to determine the optimal location and pumping rates for a groundwater capture system. The system was approved by the client and regulators and designed and installed.

Inco Corporation, Thompson, Manitoba, Canada

Managed a group of 15 professionals in the field working 12 hours a day, 7 days a week for 3-week periods. Installed 30 observation wells and five injection wells on a lake using a sonic drill rig on a barge. Constructed small barges with water pumps and installed them at each injection well location. Injected water for a period of two months and measured the head

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distribution in the normally unsaturated, sand pockets in contact with the bedrock surface. The project was to simulate future dredging activities and determine if the activities would flood the active mine 200 feet below the sand pockets. The project illustrated that dredging operations could be used and save Inco millions of dollars compared to using dry land methods.

Petro-Canada, Calgary, Alberta, Canada

Designed and installed pumping wells in various locations in Alberta. Performed and analyzed pumping tests in at each location to determine the safe yield of the wells. The wells were used for the water supply for various water flood projects to increase the percent recovery from numerous oil wells.

Amoco Canada, Calgary, Alberta, Canada

LNAPL delineation and remediation at a gas well blowout. During the drilling of a gas well in the foothills west of Edmonton and Calgary Alberta a high pressure zone was intersected and the well blew out. For several weeks the well blew out organic material the consistency of antifreeze. Designed and conducted a LNAPL distribution investigation between the well and a major river. There were several feet of product on the water table. Constructed a 300 foot long trench and intercepted the LNAPL before it reached the river.

PUBLICATIONS AND PRESENTATIONS

Jamieson, G.R. and Freeze, R.A., 1982, The Value of Mathematical Modeling for the Determination of Regional Hydraulic-Conductivity Distributions in a Mountainous Area with Limited Data, Second National Hydrogeologic Conference, International Association of Hydrogeologists, Winnipeg, Manitoba.

Jamieson, G.R. & Freeze, R.A., 1983, Determining Hydraulic Conductivity Distributions in a Mountainous Area Using Mathematical Modeling, Ground Water, March-April.

Li, D., Jamieson G., Shea D. and Lundy D., 2003, Bioslurp Modeling of Multiphase Flow and Vapor Transport, National Ground Water Association Midsouth Focus Conference: Environmental Monitoring and Modeling Issues: Hydrogeologic Model Calibration, Uncertainty and Confirmation, Nashville, Tennessee.

Li, D., Jamieson G., Shea D. and Lundy D., 2004, Multiphase Modeling to Evaluate Remedial Options at a Jet Fuel Impacted Site, Fifteenth Annual West Coast Conference on Soils, Sediments and Water, Association of Environmental Health and Sciences, San Diego, California.

Jamieson G. and Li D. 2006, Evaluation of Regional Chlorinated Hydrocarbon Plumes, Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California.

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Malaniak C. and Jamieson G. 2006, Tools, Techniques and Analysis of Fractured Bedrock, Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California.

PROFESIONAL ACCOMPLISHMENTS

Current member of the National Ground Water Association's, Awards Subcommittee.

Current member of the California Groundwater Association's, Awards Committee.

Received STAR Award for participation on National EPA research panel.

Received letters of commendation from clients such as W.R. Grace and Boeing.

Received a number of letters of commendation from former employer Woodward Clyde.

TRAINING

40-Hour OSHA Hazardous Waste Health and Safety Training- January 1991

8-Hour OSHA Hazardous Waste Health and Safety Refresher Course- Current Project Management 300 – October 2004

Waterloo - DNAPL in Fractured Rock - March 2003

Supervisor Training - May 2002

Project Management 200 - April 2001

Sales Training - February 2001

Accelerated Bioremediation of Chlorinated Solvents - October 2000

Technological Advances in Bioremediation- May 1999

Marketing Information System Workshop - February 1998

Coaching for Optimal Performance - August 1996

Advanced Business Development Techniques - May 1996

Giving Constructive Feedback - December 1995

Front Line Leadership: Your role and the Basic Principles - December 1995

Business Development Project Management - October 1995

Natural Resource Damage Assessment - April 1995

Diagnosis and Remediation of DNAPL Site - November 1993

PROFESSIONAL ORGANIZATIONS

National Ground Water Association, AGWSE, Member - 1979

American Chemical Society, Environmental, Member – 2000

Groundwater Resources of California, Member – 2003

ATTACHMENT B

PUBLICATIONS (Last 10 Years)

Li, D., Jamieson G., Shea D. and Lundy D., 2003, Bioslurp Modeling of Multiphase Flow and Vapor Transport, National Ground Water Association Midsouth Focus Conference: Environmental Monitoring and Modeling Issues: Hydrogeologic Model Calibration, Uncertainty and Confirmation, Nashville, Tennessee.

Li, D., Jamieson G., Shea D. and Lundy D., 2004, Multiphase Modeling to Evaluate Remedial Options at a Jet Fuel Impacted Site, Fifteenth Annual West Coast Conference on Soils, Sediments and Water, Association of Environmental Health and Sciences, San Diego, California.

Jamieson G. and Li D. 2006, Evaluation of Regional Chlorinated Hydrocarbon Plumes, Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California.

Malaniak C. and Jamieson G. 2006, Tools, Techniques and Analysis of Fractured Bedrock, Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California.

ATTACHMENT C

EXPERT TESTIMONY (Past 4 Years)

United States District Court, Western District Of Arkansas, El Dorado Division, Case No. 00-1062. Michelle Sewell, Jean Edith Sewell, Linda Claire Sewell Chatton And Arthur William Sewell (“The Sewells”), Plaintiffs vs. Phillips Petroleum Company, Kerr-McGee Oil & Gas Corporation, BP Amoco, P.L.C., Texaco, Inc., BHP Petroleum (Americas), Inc., Defendants.